

**EXPERIMENTAL TRAPNESTING: NOTES ON NEST RECOGNITION  
IN THREE SPECIES OF MEGACHILID BEES  
(HYMENOPTERA: MEGACHILIDAE)**

V. J. TEPEDINO,<sup>1</sup> J. M. LOAR<sup>2</sup> AND N. L. STANTON

Department of Zoology and Physiology,  
The University of Wyoming, Laramie 82071

---

Animals that utilize a single nest over a continuous period, as do many aculeate Hymenoptera, must relocate their nests on each return flight. In the summer of 1975 we had an opportunity to examine aspects of nest recognition in three species of megachilid bees that were nesting in pine and elderberry trap-nests which had been set out as part of another study. Although we were able to observe only a single individual of each species and each experimental series is incomplete, the paucity of information available concerning nest recognition behavior in megachilids warrants this note. The observations were carried out on shortgrass prairie in Albany County, Wyoming, about 13.5 km SSE of Laramie.

Observation Period One

On July 15 we found a female *Hoplitis albifrons argentifrons* (Cresson) using a 6.4-mm-bore pine nest. After observing two hours of undisturbed nest utilization during which she made 17 departures and spent 68.8% of her time out of the nest, we replaced her nest with an unused one of identical specifications. Upon returning, she exhibited several previously unrecorded behaviors before entering the foreign nest: a slower rate of return flight beginning several feet from the nest, circling of the nest at short distances, and hovering around the top. A comparison of nest utilization patterns before and after nest substitution showed that the post-substitution period was characterized by a dramatic increase in the number of departures and entrances and in percent total time spent in the nest (Table 1). Division of the post-substitution period into three equal subperiods revealed a drop in total number of entrances into the nest with time; however, total time spent in the nest and mean time per in-nest period increased dramatically, which suggests that more time was being spent to investigate the nest internally (Table 2). At 1300 hours, observations were terminated because of rain. At that time, the bee had been in the nest for 16 consecutive minutes, apparently because of the weather. When we returned several days later, the nest was empty.

Table 1. Time allocation pattern of a female *Hoplitis albifrons argentifrons* before and after substitution of a foreign nest for the home nest.

	No. of departures from nest	Mean time spent per out-of-nest period (seconds)	% total time absent from nest	No. of entrances into nest	Mean time spent per in-nest period (seconds)
Pre-substitution (total time 124 minutes, 35 seconds)	17	301	68.8	18	129
Post-substitution (total time 42 minutes, 30 seconds)	43	21	38.9	44	36

### Observation Period Two

A female *Hoplitis producta interior* (Michener) was observed nesting in a 4.8-mm-bore pine trap on July 22. During one hour of undisturbed observation, 14 exits (48.3% total time) were made. When an unused nest was substituted for the original, the returning bee began circling the nest when several feet away and occasionally alighted on a nearby rock before entering one minute later. She emerged almost immediately. Most of the next nine minutes were used for circling, sitting, or longer orientation flights; only five seconds were spent in the nest. Since nest acceptance was unlikely, we replaced the foreign trap with the original; she entered ten seconds later, and over the next ten minutes the original time utilization pattern reappeared. When both nests were offered contiguously, the "home" trap was chosen without hesitation. Next the foreign nest was placed in the correct upright position while the original was laid horizontally on the ground. After

Table 2. Division of the post-substitution time period (42 minutes, 30 seconds) into three equal sub-periods shows the increase, with time, in total amount of time spent in the nest and in time spent in the nest per discrete in-nest period for *Hoplitis albifrons argentifrons*.

Time period	Number of entrances	% total time spent in nest	Mean time per in-nest period (seconds)
12:16:10–12:30:20	16	42.5	23
12:30:21–12:44:30	17	65.4	33
12:44:31–12:58:40	11	75.3	58

circling and sitting for one minute without entering either nest, she "solved the problem" by entering the original nest. Normal foraging was resumed after she performed a brief orientation flight above the horizontal trap upon her initial departure. Subsequent entrances to the horizontal nest were made without hesitation.

We next sought to examine nest recognition when internal and external nest cues were divorced. Therefore, the situation was returned to "normal," and she resumed her previous foraging pattern. We then split the original trap, removed the nest contents, the trap halves were refitted and taped at the bottom and the trap replaced. Upon returning the bee entered without hesitation but emerged in 30 seconds to circle the immediate area and then re-enter the nest. This behavior was repeated 14 times in the next 25 minutes with all time out of the nest spent in circling, sitting and in longer orientation flights. The bee spent 70% of her time in the nest, apparently investigating internally. The experiment was terminated when she was collected for identification after making 30 pebble collecting trips spanning 18 minutes, probably for the purpose of plugging the nest.

### Observation Period Three

Our final observations were of a *Megachile montivaga* Cresson in a 6.4-mm elderberry twig on July 29. After we observed the bee for 73 minutes, during which she made 12 departures and spent 74.7% of her time out of the nest, we replaced the original trap with an unused one. The returning bee exhibited typical hesitation behavior and investigated five other traps in the vicinity, two of which she unsuccessfully tried to enter. The replacement nest was entered 95 seconds after her reappearance but she exited immediately and resumed circling and investigating the other traps. Five minutes later the original trap was returned, and the bee entered in five seconds.

To test nest acceptance with inappropriate external cues and correct internal ones, we now removed the original trap, split it, and carefully transferred the three cells as a unit to a previously split, unused trap that was then taped at the bottom and returned to the proper position. During the transfer the bee had returned and was circling the area investigating the other traps. This behavior continued for over 18 minutes until she finally entered the nest after previously circling it several times. She emerged 25 seconds later and flew, very slowly and at close range, up and down the outside of the trap for 15 seconds as if familiarizing herself with its external appearance. Normal foraging was then resumed.

Finally we tested her choice of nests by offering both the original, now internally bare, nest and the experimental one which she had been using for one hour. Upon returning, she flew directly and without hesitation into the

experimental nest. Over the next 14 minutes she made three additional returns, all to the experimental nest. The experimental nest was now home, and the original nest was foreign. When we returned several days later, one additional cell had been added and the nest had been plugged.

### Conclusions

Although data for only a single female of each species are available, the results of the three experimental series seem consistent in indicating the hierarchy of cues used for nest recognition. The three species all seem to use topographic cues when in the general nest area. Specific nest recognition, however, depends upon both external and internal nest cues, and it appears that to be accepted, a nest must ultimately be in the appropriate stage of internal workmanship. At least for *Megachile montivaga*, external cues, which may be the texture and pattern of the outside of the nest, can be overridden when foreign, if internal contents are correct.

### Acknowledgments

The manuscript was substantially improved by the comments from John Alcock, R. J. Lavigne, and F. D. Parker. We thank the owners of the Dirt Farm, Inc. for the use of their land and NSF for support under BMS 75-14044.

### Footnotes

<sup>1</sup> Present address: Bee Biology and Systematics Laboratory, Agricultural Research, Science & Education Administration, USDA, Utah State University, UMC 53, Logan 84322.

<sup>2</sup> Present address: Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830.